THE GLASS INDUSTRY

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FLEXIBILITY THE KEYNOTE OF NEW BROCKWAY PLANT

Plant No. 2, in production since February, contains many novel engineering features and reflects the management's intention of providing for future expansion without costly changeovers.

Plant No. 2 of the Brockway Glass Co., Inc., has been in operation for approximately five months. Fires in the new furnace were lighted in January. Glass was delivered in February. By March most of the kinks had been ironed out, and now a sufficient time has elapsed to make it possible to obtain operating data and to appraise values. As the newest container factory in this country, a study of its engineering features will be of interest to the industry in general.

Plant No. 2 was built for the same reason most No. 2 plants have been built—expansion. No. 1 plant was already over-crowded. Though No. 1 had two tanks, the first was in flint and the other amber, and when one tank went out, production on that color just had to stop. Business was that good, it demanded an additional producing unit.

In planning the new factory, the most important consideration was flexibility. There must be room to grow; the layout must be such as to readily adapt itself to changing conditions. In the operation of Plant No. 1, the management had shrewdly observed that when an installation is moved or changed, a substantial proportion of the investment is inevitably tossed out the window. Therefore, while it costs more initially to provide full flexibility, the money is many times saved in the long run.

Evidence of this yen for flexibility will be noted throughout this discussion. For example, the reservoir contains 100,000 gallons of water when only 65,000 is needed today; if a new tank is needed, a new furnace room can be built paralleling the present one; the warehouse can be extended by knocking out one end; the machine shop enlarged or moved entirely in a few hours by taking down its galvanized iron side walls; the compressor room is built sufficiently large to house a possible second compressor; and so on.

Plant No. 2 is located at Crenshaw, two and a half miles east of Brockway. This site was picked for several reasons; it is home territory, a source of trained labor, and where the workers can be near their homes. (A 30-acre plot on the highway across from the factory has been set aside for employee new homes.) It is close to all services necessary to operate the factory—water comes by gravity from the main reservoir of the local water company, the power lines of two utilities companies cross near that point; it is close to a natural gas pipeline; four railroads are close to hand; U.S. highway 219 passes within a few feet of the main entrance, an important factor since 30 per cent of all freight goes by motor truck.

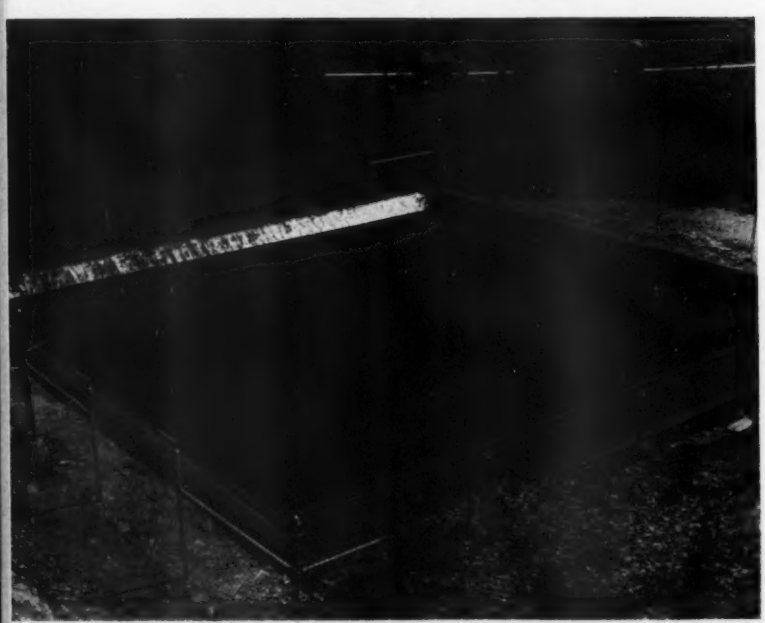
Reference has been made to the two power lines serving the plant. The interchange is rather unique. One line is supplied by the West Penn Company; the other by the Brockway Light, Heat and Power Company, which buys its power in turn from Pennsylvania Electric. If either line fails, a switch automatically changes the

Plant No. 2, of the Brockway Glass Co., Inc., looking down from the factory's 100,000 gallon reservoir.

The Brockway Light, Heat & Power lines are seen coming in from the right, with the West Penn lines on the left. The interchange is seen prominently in the foreground, between the poles, and the transformers are close to the factory, on the right.

Engineer Leon F. Robertson, who with Mr. Hess planned this model factory. Mr. Robertson comes from Frazier-Simplex, Inc.

(Right) Superintendent William J. Mathews is not a slavish follower of tradition. Many of the novel operating details of this plant are his brain children.



The 100,000 gallon reservoir which supplies plant No. 2. Since the flow of water to and from the reservoir is by gravity, no pumps are needed.

power to the second line, an operation requiring about 13 seconds to complete. Because of a difference in line voltages, between the two sources, an Allis-Chalmers transformer is required. The change back is by manual re-set. Incidentally, this sub-station can carry not only the new factory, but also No. 1 factory and in fact the whole town of Brockway. The voltage for Plant No. 2 is regulated through a bank of 3 Allis-Chalmers transformers. Total capacity is 1,000 K.V.A.

Before entering the factory proper, we will take one more look at the reservoir, which is located on a hill overlooking the plant. As already stated, this is of 100,000 gallon capacity and is fed by gravity from the city reservoir. The consideration which led to this type of water reservoir was cost. To erect a tower holding even the minimum 50,000 gallons required by the insurance underwriters; to heat this tower in winter; and to keep it in repair, as by painting, etc., meant substantial outlays of money both initially and over the life of the factory. Here again, the slightly higher cost of erecting a concrete, out-door reservoir will many times repay the management as the years go by.

When the Brockway Glass Company decided to erect the new factory, it turned to the Frazier-Simplex Company for engineering advice. It so happened that Mr. Leon F. Robertson of that company was planning to sever his connection and start a business of his own. Mr. Robertson, together with Mr. F. B. Hess of Brockway Glass Co., planned the new factory.

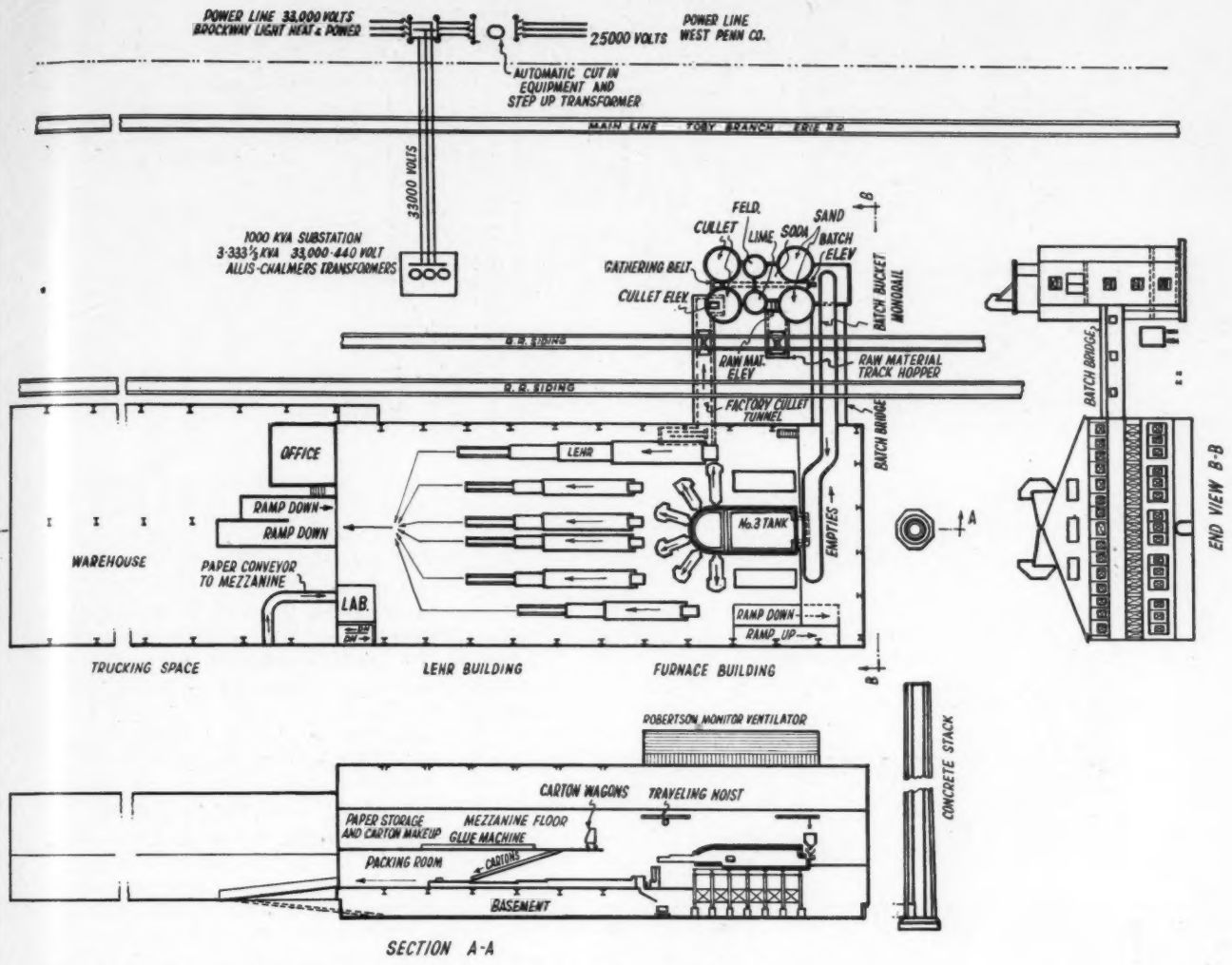


Diagram showing the layout of the factory and the location of its equipment.

The batch house is of the silo type, built of monolithic concrete. It was designed and constructed by the Rust Engineering Co. and the E. P. Dandridge Co., both of Pittsburgh. Raw materials delivered by covered hopper cars are dropped through the tracks on to a belt conveyor which feeds a bucket elevator. Should box cars have to be emptied, a hopper-like receptacle slides out on its own tracks under the car door, and the cars unload into it. The bucket elevator delivers into a swivel chute that directs the materials into the bin or section designated for that item. There are eight of these sections: two of 300 tons each for sand; three 200 ton sections for cullet; and three of 150 tons for lime, feldspar and soda ash respectively. This gives a total raw material storage capacity of 1650 tons.

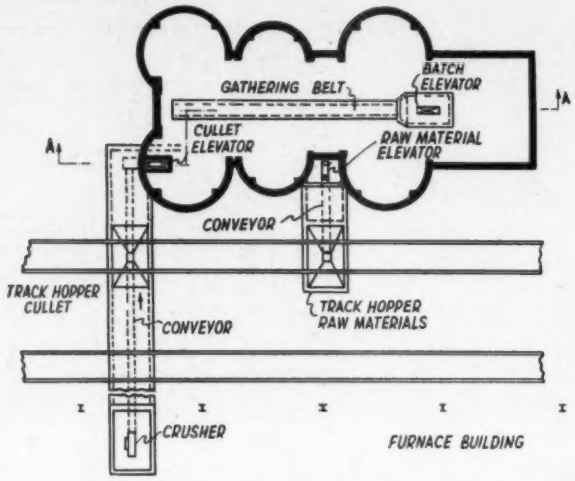
A separate conveyor system is provided for handling cullet. A conveyor belt, running from the factory through a tunnel under the tracks to the batch house, carries factory cullet to cullet storage. At the point where the belt passes under the tracks, it can pick up foreign cullet unloading from cars. This conveying system terminates at the top of the cullet silo, where a portable conveyor directs the load into one of the 3 cullet storage bins. A separate plant for cleansing foreign cullet is projected but not yet constructed.

As batch materials are withdrawn from storage, they fall by gravity into hoppers with Toledo scales. These are dial type, Printway scales that provide a permanent record of the weighing. From the weighing hoppers, the batch materials are conveyed by a gathering belt to another bucket elevator, and thence to a surge hopper located above the Ransome mixer.

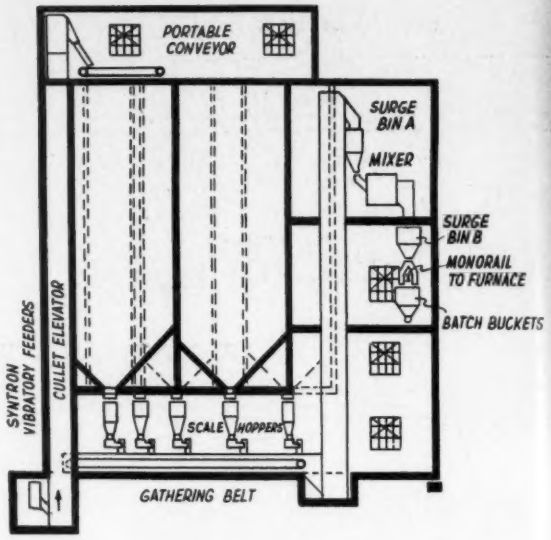
An important apparatus in the cycle just described is a Syntron vibratory feeder, located directly under the weighing hopper. It performs three functions: (1) eliminates over-charging and overloading of the gathering conveyor; (2) distributes the raw materials over the conveyor belt in even layers and partially intermingled; (3) insures uniform loading of the elevator, with each bucket carrying an identical load. This last named point is considered extremely important, as overloaded buckets often plug the elevator. Also it smooths out the mixing cycle by controlling the time required to empty the weigh hoppers.

The Syntron feeders are only partially automatic, the gate controlling the flow from the weigh hoppers being

The Batch House.



PLAN



SECTION A-A

manually operated. Manual operation is preferred to the automatic, as it is thought this avoids trouble arising from batch material that has become caked in storage which, in an automatic system, might clog the gates and prevent their closing tightly.

(Above) Raw materials are unloaded from covered hopper cars through the tracks, or from box cars into the sliding hopper seen on the right.

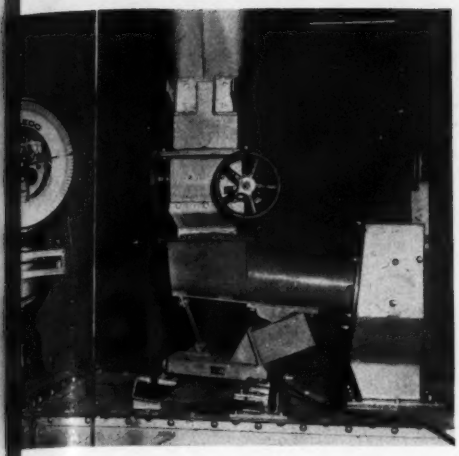
(Left) A view of the 50 cu. ft. stationary type Ransome batch mixer.

(Right) Swivel chute on top of the batch house that directs the raw materials to the proper silo. The portable conveyor in the background delivers the cullet into any one of the three cullet storage silos.

Continuing on to the batch mixer, we find another surge hopper placed beneath the mixer, and from this the mixed batch drops by gravity into batch cans that are pushed by hand on a monorail system over a bridge connecting with the furnace room and doghouse. Here, the Frazier-Simplex blanket-type batch feeder is used in connection with the Frazier-Simplex suspended back wall.

The entire batch cycle is controlled by a timing system whose controls and signal lights are to be found on a master panel located on the ground floor of the batch house. This can be set to give any cycle desired. Another panel is located on the floor where the batch cans are loaded. This has no timing devices, but has lights that indicate the movement of the batch and its exact position at any given period of its cycle. This enables the operator to gauge accurately the loading of his batch cans.

Glass melting is done in a side port, regenerative tank, which is a Brockway design of 467.5 square feet, and 24 inches deep at the refining end. The luminous flame system of firing is used, with natural gas, and the design of the tank was checked by Toledo Engineering Company for that purpose. A Blaw-Knox air valve is used for furnace reversal. The tank has a straight throat. Corhart supplied the block for the sidewalls of the



(Left) The bottom hopper of one of the silos. The materials are weighted by Toledo dial type, Printway scales and flow by gravity through a Syntron vibrator to the gathering belt.

(Right) The secondary panel of the batch timing system. By means of signal lights the operator can follow the movement of any given lot of batch through the mixing cycle.

melting and refining end as well as the tuckstones and port entrance jambs. The bottom blocks are Laclede-Christy super-flux. Checkers and regenerators contain various brick placed there for test purposes. Regenerators are insulated with insulating fire brick.

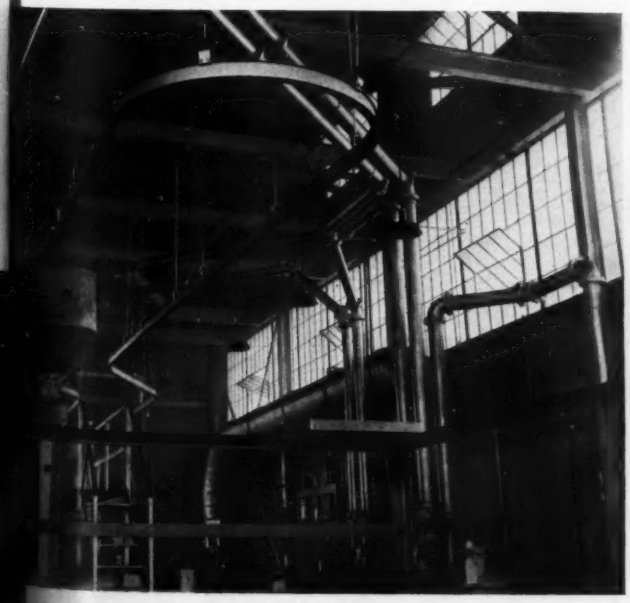
Equipment of the furnace includes an automatic damper control of Leeds & Northrup make, and this company also supplied its Micromax temperature controls for the furnace and feeders. Air-gas ratio meters are by Bailey. The wind system for cooling the tank blocks and the glass forming machines is a Kirk & Blum installation. Nozzles used on the former are of special design and are undergoing test on this tank. The piping for this entire system is run outside the building so as not to interfere with moving equipment. The stack (lined with fire brick) is of concrete poured in sections, slightly tapering toward the top, and rises to a height of 164 feet with a mean inside diameter of five feet. It was erected by the Rust Engineering Company.

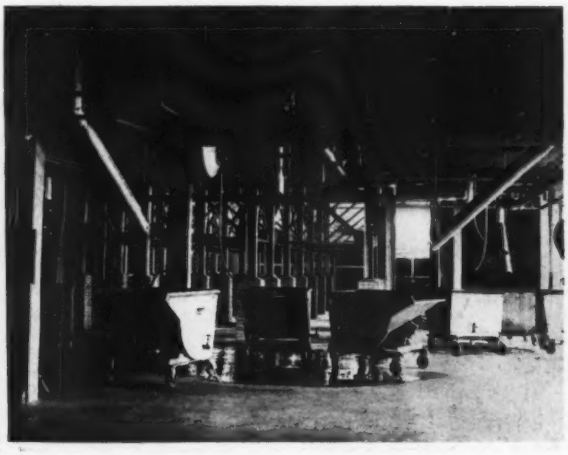
There are six Hartford forehearths and feeders; of the latter, there are 5 type KU and 1KW. Forming

(Above) Rear view of the Frazier-Simplex batch feeder and the suspended back wall of the tank. The cans are moved down the monorail by hand.

(Left) The rear of the furnace buildinng, with a batch can charging the batch feeder. Note the air and gas piping and the furnace control panel.

(Below) Cullet carts in position under the tank. Plenty of light and head room here.





An Ingersoll-Rand compressor driven by a Westinghouse motor supplies the compressed air needed.

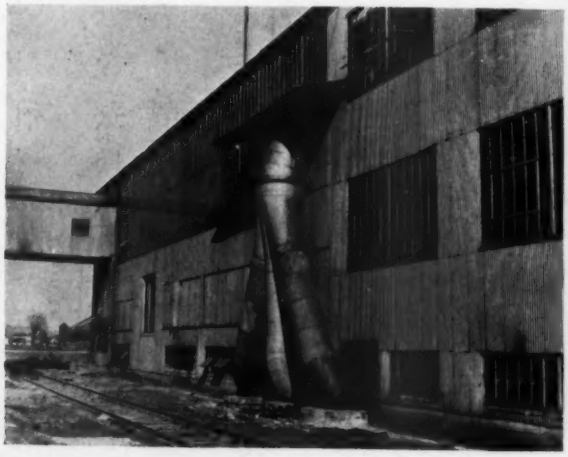
machine equipment includes two IS fours, one Lynch LA-00, one Lynch RS-00, one Lynch 10 and one Lynch R-00. The lehrs and lehr stackers are Hartford. High pressure air is supplied by an Ingersoll-Rand Type PRE compressor of 2200 cfm capacity. This is driven by a Westinghouse 350 hp synchronous motor. A Fuller C-70 rotary compresor rated at 325 cfm is installed both as an auxiliary unit in case of shut downs, and also for operating the feeders. This is driven by a 50 hp motor and will cut in automatically when the pressure in the line drops two pounds. Hooked up with the compressors is an Adams aftercooler. In the operation of the two Hartford IS machines the compressed air is stepped down from 45 to 30 pounds by the use of A. W. Cash Company's "Streamlined" type 1000 pressure reducing valves. This type of valve is said to eliminate turbulence, giving constant reduced pressure. All vacuum requirements are handled by a 15 hp Ingersoll-Rand vacuum pump. Compressed air lines and receivers are built over-size for stability and to allow for future expansion.

Cooling air for the machines is supplied by two 50 hp and one 25 hp Clarage fans, delivering air at 9 inches static pressure. A 60 hp Clarage fan delivers cooling air to the tank at 6 inches static pressure. This latter fan is equipped with a variable speed sheave. In the unlikely event of a complete power failure, a Ford V-8 industrial unit is mounted at the far side of the fan, equipped with sheaves and belts, and this can be hooked up to the fan in a very few minutes.

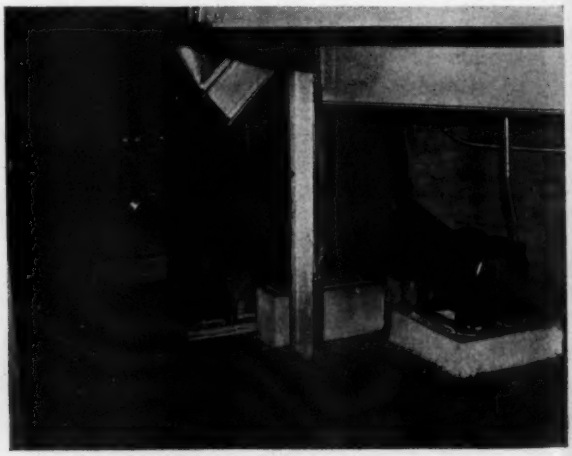
Any visitor to the Brockway plant is immediately impressed with the lighting system in use at the packing and inspection tables. This is an outgrowth of the fluorescent lighting system developed in the No. 1 factory and benefits from the experience gained there. In the No. 1 plant two 48-inch two-tube units were placed over the inspection end of the lehr belt and slightly above the inspector's head; in the No. 2 plant, three two-tube units are used, and a new position of the lamps has been determined after long study. One of the three units is

Air nozzles, for cooling tank blocks. These nozzles are a special Kirk & Blum design undergoing test at Brockway.

Cooling-air pipes are run outside of the building to conserve room in the basement. Batch bridge in the distance.



The 60 hp Clarage fan for tank cooling. The Ford V-8 standby unit in the background can drive the fan in case of a total power failure.



(Left) The mold repair shop, located in the basement. Spacious, well lighted, and fully equipped to carry on mold repairing and maintenance work.

(Below) Carton chutes leading to the packing department on the floor below. Carton stitcher and carton dollies in the background.

placed directly over the discharge end of the lehr belt and close to the bottles; the other two are placed at right angles to each other over the packer. The combination affords even lighting of the bottles. The illustrations below show the position of these lamps. Due to the enormous span and height of the machine room, a novel flood lighting system was installed here and so designed that the machine operator was never in the shadow.

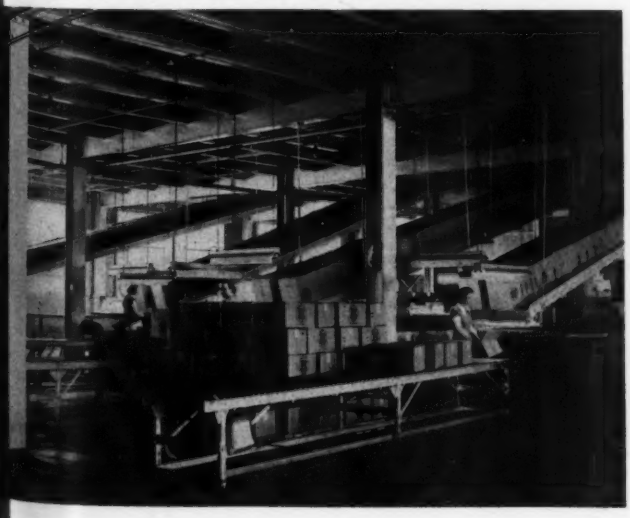
The carton room is located on a mezzanine floor over the packing room, as the floor plan diagram shows. Here the cartons are made up, and stitched or glued. Brockway obtains its supply of cartons principally from the Northeastern Container Co. A Lamson portable conveyor can be moved to either the railroad or to the trucking side of the warehouse, and this carries the cartons by a Lamson belt elevator upstairs to the carton room. J. L. Ferguson Co. carton sealers are used, and Bliss Bostitch carton stitchers.

When made up, the cartons are stored in individual pressed steel bins. These are the special design of

(Right) Stitching a carton on a Bliss Bostitch stitcher. The wheeled carton-dolly next to the worker, saves time in handling the assembled cartons.

(Below) Three inspection and packing stations. Filled cartons are placed on pallets for moving to the warehouse. Light plus plenty of space.

(Lower Right) Inspection and packing station. Note the position of the fluorescent lighting units. The reject wagon can be moved by hand or by lift truck.



Cullet is easily moved by this Clark gasoline driven high-lift fork truck.

There are two Clark units in the factory, serving all departments. Here is one stacking cartons in the warehouse.

Superintendent W. J. Mathews and were built by the Powell Pressed Steel Company. Mr. Mathews prefers this bin or carry-all method of carton handling to the accepted skid method, as he claims it makes warehouse storage far more flexible. Typical of the many refinements to be found in the factory, there is a double floor under the carton room, the top of which is in matched maple. The carton room is insulated by a false ceiling containing a four-inch layer of glass wool.

Plant No. 2 has its own equipment for routine testing of the bottles made there; all other testing is done at Plant No. 1. The testing laboratory is located in a corner of the main floor, and it contains all of the approved equipment for routine thermal shock and pressure tests, and for testing annealing and glass distribution, including a Preston pressure testing unit and a Polaroid model 110 polariscope. The technique developed by the Preston laboratories and the Glass Container Association is followed. Every week bottles are sent to the Hartford-Empire Co. as a further check on the manufacturing processes.

The building itself is of structural steel, with corrugated iron siding. The furnace and inspection building is 240 feet long by 100 feet wide. The warehouse is 382′ 6″ long by 110 feet wide. Floors generally speaking are of concrete, with exceptions here and there as have already been noted, and the machine floor of the blowing room is bricked. Over the tank room is an 80 ft. H. H. Robertson ventilator.

Space does not permit of detailing all the minor but important features of this splendid factory, built at a cost of approximately $600,000. To the experienced glassman, the layout of the factory, diagramed on these pages, will supply far more than word pictures, and the photographs tell their own story of efficiency of operation. These pictures, incidentally, were taken by Mr. John Ferguson of the Brockway Glass Co. Mr. Ferguson is an expert photographer, as the pictures themselves give proof; in fact, it is seldom an editor is privileged to receive such excellent examples of photographic skill.

A view of the warehouse showing the one column support. The width of each bay in the warehouse matches a car door thus f..cilitating loading and unloading.

GLASS vs. ELASTI-GLASS

Outcome of the Federal Trade Commission's suit against S. Buchsbaum & Co., Chicago, will determine whether plastics can be considered glass or whether plastic products with glassy names are being sold unfairly in competition with glass.

The Federal Trade Commission will hold the third hearing of its suit against S. Buchsbaum & Co., Chicago manufacturers of Elasti-Glass, in Washington this month. The first hearing took place in Chicago on April 3; the second, a week later in Toledo, April 11. Adjournment was then made until July to give the trial examiner, William C. Reeves, an opportunity to hear some complaints docketed on the Pacific Coast, and the respondents in the Elasti-Glass matter preferred, in litigation as technical as this, not to change examiners.

Although the case has not been reported widely by the press, its issues vitally affect the future of the glass industry. For more than a year, glass manufacturers have been concerned over merchandise that has appeared on the market that was not made of glass, yet looked like glass, had a name suggesting glass, and was often thought by the public to be glass. Such articles were made of plastics, and it began to be apparent that the similarity both of appearance and nomenclature was bound to cause trouble. If belt buckles, wrist watch straps, suspenders, etc., were being made of plastic and sold as glass, other products would follow. The confusion that would result can be easily imagined, and no telling what might be the consequences.

However, in the course of time the Federal Trade Commission took cognizance of the situation, and issued a complaint against one of the manufacturers of these products. In essence, the complaint alleged that Buchsbaum & Co., in selling and advertising their Elasti-Glass products, imply and represent them to be glass; whereas, in fact, there is no glass in them—that Vinylite is not a glass. And that such acts constitute unfair and deceptive practices in interstate commerce.

The respondents answer by stating categorically that Elasti-Glass *is* glass—organic glass. The answer goes on to recite that Elasti-Glass is clearly differentiated from inorganic glass by its elasticity, a property that inorganic glass does not possess. And the respondent naively states that since his suspenders and other articles of wearing apparel are worn close to the body, he hopes devoutly they never become associated in the public mind with inorganic glass, because its brittleness, scratchiness, etc., would suggest the most unpleasant association for the wearer.

One of the important exhibit introduced into the trial, and one referred to repeatedly, is a letter written over the signature of Mr. Herbert Buchsbaum and addressed to his representatives. This states why he considers Elasti-Glass to be glass. This letter, excepting for the final paragraph, reads:

To our Representatives:

So many customers are inquiring as to the exact nature of our Elasti-Glass material that it is necessary you have this information so you may handle inquiries intelligently.

Elasti-Glass is made from coal and salt. It is really a form of glass as defined by the latest *Encyclopaedia Britannica*, Page 413, Vol. 10, which we quote verbatim:

"To the chemist and physicist the word glass signifies the special state of matter assumed when a liquid substance is cooled continuously, and becoming more and more viscous, finally hardness, without, at any stage, crystallizing. Glycerine at low temperature, resins, pitch, sealing wax exhibit such characteristics, although the term glass is often confined to transparent materials. Substances in this under-cooled state are spoken of as having assumed the glassy vitreous condition, they have in general, properites like common glass."

Elasti-Glass falls in this category under the title of resin. Being a synthetic resin scientifically produced and distinctly transparent it differs from synthetic resins heretofore produced only in that it is elastic and transparent and will withstand the ravages of age, heat, cold, oxidation or acids to an amazing degree.

On page 398, Vol. 10, of the *Encyclopedia Britannica*, glass is defined as "a hard substance, usually transparent or translucent, which from a fluid condition at a high temperature has passed to a solid condition with sufficient rapidity to prevent the formation of visible crystals." This definition describes exactly how Elasti-Glass is made from the heating and mixing of coal and salt with a special catalytic agent and chemicals to induce the formation of certain gases and distillates, which results on cooling in a synthetic resin glass which we have named Elasti-Glass.

The new feature that you are introducing, besides the transparency, is the elasticity of the material, whereby it may be stretched or bent in countless ways and will return, for all practical purposes, to its original shape.

Herbert Buchsbaum
President

Attorney for the Commission, Eldon P. Schrup, has called so far two technical witnesses for questioning on the subject of what is glass? is there such a thing as organic glass? is Vinylite or synthetic resin glass?

Dr. Hostetter defined glass generally as "an inorganic product of fusion which has cooled without crystallization." Amplifying this abbreviated definition, he stated further that glass as a material requires a different definition than glass as a state of matter. And asked to define "organic" glass, he answered: "The expression itself is a mixture of terms that cannot possibly be correct. Glass is defined as an inorganic material; it is made from earthy products. When you say 'organic glass,' you are saying 'organic inorganic products,' which of course just doesn't make sense."

Upon questioning, Dr. Hostetter stated that in his opinion the term "vitreous" should not be applied as a characteristic of the so-called organic glasses. The act of vitrifying is one of high temperature. Whereas the process of glassmaking, involving as it does high temperature, is vitrification; yet, one cannot possibly submit organic glass substitutes to anything like such high temperature, in the process of manufacture or afterwards, without decomposing or destroying them utterly.

Another of Mr. Schrup's witnesses was Dr. Joseph D. Ryan, assistant director of research at Libbey-Owens-Ford Co. He described glass as "a product of fusion of inorganic or earthy materials which, after fusion, are cooled down without crystallization or reversion to the crystalline stage, thereby remaining in what might be termed the amorphous condition."

Dr. Ryan stated that most references to the term "organic" glass were to be found in the foreign journals, as British and German, and that these do not concur to

any extent with American publications. Qualifying as an expert on plastics as well as glass, Dr. Ryan gave a short resume of the development of transparent plastics from celluloid down to safety glass, and stated, "Later on, almost any material that was transparent was termed a glass substitute and in some cases writers may have termed them 'organic glasses'; but in my opinion glass is a permanent material; it is hard; it is transparent; it is not soluble in organic solvents; it is relatively and almost completely insoluble in water; it is unaffected by moisture; its surfaces can be ground and polished to a bright luster, which luster it retains. It can be worked by being reheated or heated into a softening range at elevated temperatures; it has a high light transmission as ordinarily use, and retains its properties of light transmission.

"Plastic materials have only a few properties of glass itself. I have seen a large number of plastic materials, including the so-called 'organic glasses' of the urea-formaldehyde type, of the polymethol methacrylate type, of the polystrol type, and have actually tested these materials in comparison with glass itself. All of them, even the hardest, are only approximately one-half the hardness of glass. On use in windows in automobiles where the plastic is going to be exposed directly to the weather, it becomes scratched up and non-transparent. After a short time, there is a tendency on the part of the plastics to decompose, either due to the action of sunlight, heat, moisture, or a combination of all three factors. The rapidity with which any one individual so-called organic glass will decompose is a function of the particular ingredients used in making the resin. Some are more stable than others, but none compares favorably with glass."

Dr. Ryan made a very important point when he stated that he did not consider Elasti-Glass, which he had analyzed, as belonging even in the classification of so-called organic glass. A search of the literature had not revealed to him where a writer who uses the term "organic glass" has classified the Vinylite materials as organic glasses. The so-called organic glasses are hard; these are soft and would abrade easily, he said.

Dr. Ryan tore into Mr. Buchsbaum's letter to his representatives in which he stated: ". . . Elasti-Glass falls into this category under the title of resin. . . ." He said that the resins to which Mr. Buchsbaum made reference could be cooled up and cooled down and resume their glassy characteristics," but Elasti-Glass is unlike these resins—one cannot heat up Vinlylite resin of this type and cool it down and obtain a glassy residue. Dr. Ryan continued to quote from this same Buchsbaum letter and to rip it to pieces in this fashion.

The defense has cited a few references to "organic" glasses in the literature, including some by Prof. Turner; Dr. Gordon M. Kline; Dr. George W. Morey; Gibson & Giaque; *The Encyclopaedia Britannica*, Park, Thomas and Light's *Some New Heat Data for Organic Glasses*, and Dr. Harry Moore's *Glasses, Organic and Inorganic*. Chem. & In., Nov. 25, 1939, P. 1027. In this latter, Dr. Ryan called attention to a statement that also appeared in this paper to the effect that if materials decompose on meeting, they are not considered to be glasses.

When the hearing resumes in July, it is expected that Dr. Hostetter will resume his testimony, interrupted by illness in Toledo, and that Mr. Schrup will call other glass experts. This will finish the presentation of the Commission's case, after which the defense will be given an opportunity. It is believed this last will take place in Chicago. By the time the Trial Examiner will have made his report to the Commission and the Commission issued its orders, more weeks will elapse. Meanwhile the case of glass vs. plastic remains one of the greatest import to the entire glass industry.

LOWER TARIFF PROPOSED ON ARGENTINE GLASS SPECIALTIES

Hearings on the proposed trade agreement with Argentina, the provisions of which are of concern to the handmade glass makers of the United States, were opened on June 23 in Washington. Charles W. Carlson, president of the United States Glass Co., appeared as representing the American Glassware Association, which includes about 60 per cent of all manufacturers of the type of ware to be affected by the treaty.

Previous to the hearing, the Association had filed a brief expressing its willingness to cooperate with the Government in its efforts to encourage trade with Latin-American countries and assenting to the proposed tariff reduction insofar as it affects Argentine "specialties." However, the brief made clear the Association's interpretation of the word "specialties" as meaning generally articles characteristic of that country.

The brief pointed out that imports of Argentine specialty glassware had been practically negligible, and could do no harm to American handmade glass workers. However, if a broad interpretation were given to the term "specialty," then serious injury would result; since Japan, Czechoslovakia and other nations would receive the same preferential rates and their goods do compete seriously in our markets. Because of our high wage rates, American handmade glassware cannot be exported, and its dependence upon the domestic market makes it imperative to protect the 14,000 individuals employed on this type of ware. The skill of the foreign workman is said to be as good as the average level in America; the wage scale, however, is nearly 75 per cent less.

Speaking in behalf of the American Glassware Association, Mr. Carlson stressed the point that Argentina's exports of glassware had been quite insignificant, while she had imported a great deal from Czechoslovakia, Germany, France, and Belgium. It is therefore difficult to find a reason why Argentina should seek tariff concessions to invade the American market. Far better for that country to build up its industry to a point of self-sufficiency, which would release that much foreign exchange for other purposes. However, Mr. Carlson stated, if the negotiators must have tariff concessions, he requested that the American Glassware Association be allowed to assist in writing the description of the items, so that true Argentine specialties could be admitted and not the product of other foreign nations.

WANTED—Decorating Shop Foreman. State age and experience and where last employed. Box 41, THE GLASS INDUSTRY, 11 West 42nd St., New York City.

WANTED TO BUY: Four mold Rotary Presses. State size of mold presses will take. Dunbar Glass Corp., Dunbar, West Virginia.

A RAPID METHOD FOR DETERMINING THE OPACITY OF GLASSES TO THE NEAR-ULTRA VIOLET

By W. R. LESTER
Maryland Glass Corporation

In the development of colored glasses which are to have specific light transmissions it is usually necessary to employ spectrophotometric methods in order to determine if the glass possesses the desired transmission curve. Spectrophotometric determinations, especially if they are to include measurements in the near ultra-violet region, require equipment which usually is not available in the ordinary laboratory, and such determinations are therefore made by commercial laboratories. If many determinations are to be made, as in the case of development or control work, not only is the cost excessive, but other factors such as the length of time involved in preparing the sample, the time required between the submitting of the sample and the resulting report are also handicaps.

In many cases the opacity of the glass to the region between 4000 and 2900 A U is the main information needed. This is particularly true of colored glass containers which must have specific absorptions in the blue, violet and ultra-violet regions if they are to be used for packaging light-sensitive materials. Fortunately this region is responsible for certain physical and chemical effects that can be readily adapted to both the quantitative and qualitative measurement of the radiations in this region. One of these effects is that of fluorescence. The region between 4000 and 2900 A U is absorbed by many substances and the energy so absorbed, instead of being converted to heat, is re-emitted in the form of visible light. This phenomena is known as fluorescence.

Bloch[1] has used this property of fluorescence as a quick method for determining the transparency or opacity of glasses to the near ultra-violet region. In this procedure, the glass to be tested is held between a sheet of white fluorescent paper and the light source; the more ultra-violet light absorbed by the glass, the less fluorescent the paper appears. The fluorescence of the paper is then compared on a graded light scale or against a wedge of glass of known transparency.

The author[2] has used a similar procedure in a study of the transparency of various colored container glasses to this region. The method consists of placing the glass to be tested between a light source and a fluorescent material and noting the absence of or the degree of fluorescence. Various light sources such as the carbon arc, the mercury arc, the sun lamp, a high wattage electric lamp, or the sun itself may be used.

The near ultra-violet region is isolated by the use of "Woods" glass. This glass is a nickel oxide containing glass which appears black by reflected light and transmits only those radiations between 4000 and 2900 A U. Cobalt or manganese glasses containing sufficient coloring material so as to appear black may also be used, but in these cases the region transmitted may also include a considerable part of the visible blue and violet radiations. As the fluorescent effect is more readily seen in the dark, the light source and ultra-violet filter may be housed in a dark cabinet or the observations may be made in a darkened room.

While there are many fluorescent materials that may be used as the ultra-violet indicator, a 0.1 per cent solution of quinine sulphate in water, which has been acidified with a few drops of sulphuric acid, is very satisfactory. Such a solution absorbs radiations below 4000 A U and fluoresces with a brilliant blue color.

In Table I the results obtained by this method on a series of glasses with known light transmissions are given, while Table II gives the results obtained on various samples of present-day colored container glasses. The transmission of the glasses in this region being expressed by plus signs, the number of which indicates the intensity of fluorescence. Opacity to this region is indicated by a minus sign.

TABLE I

RESULTS OF THE FLUORESCENCE TESTS ON MATERIALS WITH KNOWN LIGHT TRANSMISSIONS

Material	*Cut Off A.U.*	*Degree of Fluorescence*
Window Glass	3000	+++
Cobalt Blue Glass	3000	+++
Light Amber Glass	3150	++
Copper Blue Glass	3400	++
Wratten Filter No. 2	4000	—
Dark Amber Glass	4300	—
Noviol B	4400	—
Sextant Green	4500	—
Wratten Filter No. 8	4700	—
Wratten Filter No. 15	5100	—

TABLE II

RESULTS OBTAINED WITH COLORED GLASS CONTAINERS

Glass Color	*Degree of Fluorescence*	*Thickness*
Amber A*	++	1.8 mm.
Amber A**	—	5.0 mm.
Amber B	+	2.0 mm.
Amber C	—	4.8 mm.
Amber D	+	4.0 mm.
Amber E	—	2.2 mm.
Green A	+++	5.0 mm.
Green B	+++	6.5 mm.
Black Green	—	3.0 mm.
Opal	+++	2.1 mm.
Opal	++	6.0 mm.

*Side of panel bottle, Amber A.
**Front of panel bottle, Amber A.

It is realized that the method does not take into account the fact that a narrow transmission band in this region will give the same general effect as complete transmission throughout the region. However, commercial colored glasses such as are used for containers do not have transmission curves of this shape. In addition, complete aborption of the region between 4000 and 2900 A U is the property that is desired in such glasses.

[1]Gas und Wasserfach, 70, 1229; 1927; also Chem. Abs. 22, 850; 1928.
[2]Drug Markets, 28, 347; 1931.

DESIGN OF BOTTLES THAT CONTAIN CRYSTALLIZING LIQUIDS

By F. W. PRESTON

In Rock and Rye products, and similar ones, the "rock" (sugar) is sometimes allowed to crystallize from the initial liquid contents, which become supersaturated when cooled from a temperature of about 160°F. to storage temperature. Left to themselves, the crystals naturally settle on the bottom, being denser than the liquid. In many cases the layer of crystals becomes pretty thick and solid, and under certain circumstances, discussed below, it has been found to cause the bottle to break. This fact has been known for many years, and various palliatives have been tried. One of these attempts to cause the sugar to crystallize on a sprig of herbage, thus preventing all of the crystals from settling on the bottom. The result often is pleasing aesthetically, but it is not always sufficient technically. Better results can be obtained, as a rule, by watching the design of the bottle and the distribution of the glass therein.

The stresses set up by the crystallizing component are not the same as those due to general internal pressure[1] or to internal vacuum[2]. They resemble the former in that the sugar exerts a bursting pressure on the container walls; but this pressure is confined to the proximity of the sugar, and the stresses in the glass due to the pressure die out at a moderate distance from the base. Thus the problem of designing and making containers for these products is the problem of having the basal part of the bottle strong enough.

In general, the pressure exerted is uniform in a radial sense, so that the ideal shape of the bottle is, once more, circular, if we want maximum strength with minimum weight. But this requirement does not apply to points at any appreciable distance above the sugar line, so that in its upper portions the bottle may be parallel, or of any reasonable shape. In this respect there is more variety and scope for designing than with pressure ware proper.

The stresses in the glass vary greatly with temperature, but probably in a complicated way. The crystallizing of the sugar is a slow process, and if we assume that once

Fig. 1. Before Crystallization. 70° F.

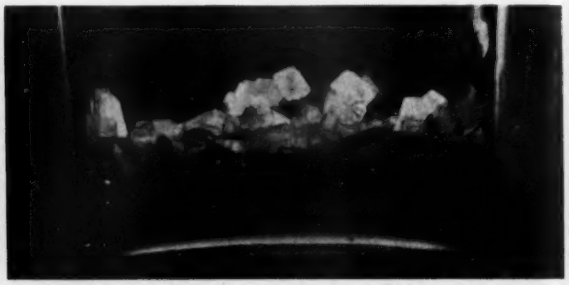


Fig. 3. After Crystallization. 30° F.

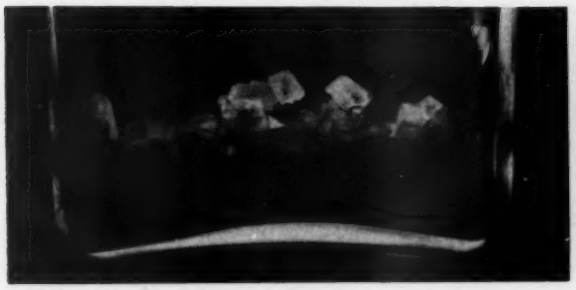


Fig. 2. After Crystallization. 70° F.

Fig. 4. After Crystallization. 50° F.

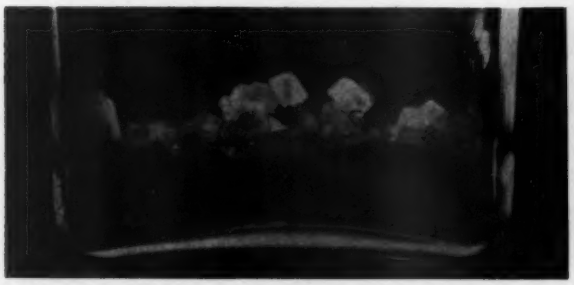


Fig. 6. After Crystallization. 80° F.

Fig. 5. After Crystallization. 60° F.

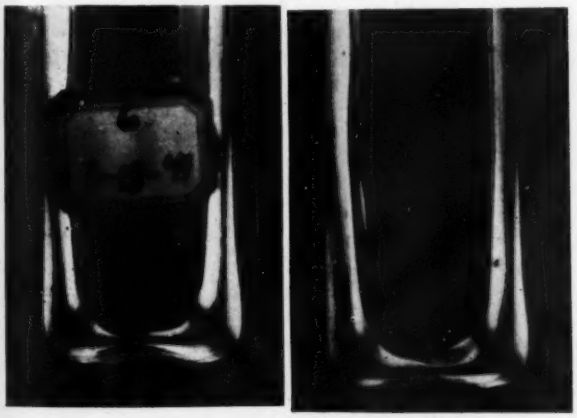
equilibrium has been reached the sugar does not redissolve rapidly on raising the temperature nor recrystallize rapidly on a drop of temperature, then the important factor is the relative thermal expansion of sugar and glass. Now sugar expands with heat about four times faster than glass[3], and so, as the temperature is raised, the pressure exerted by the sugar increases rapidly.

These phenomena are illustrated by photographs taken in polarized light, with the bottle immersed in a bath of monochlorbenzene. The sugar was allowed to crystallize from solution over a period of several days at a temperature close to 70°F. The appearance of the bottle in polarized light, at 70°F. and before the crystallization had started to any appreciable extent, is shown in Figure 1. The strains here visible are small, and are due to the annealing treatment. They are not due to the contents of the bottle.

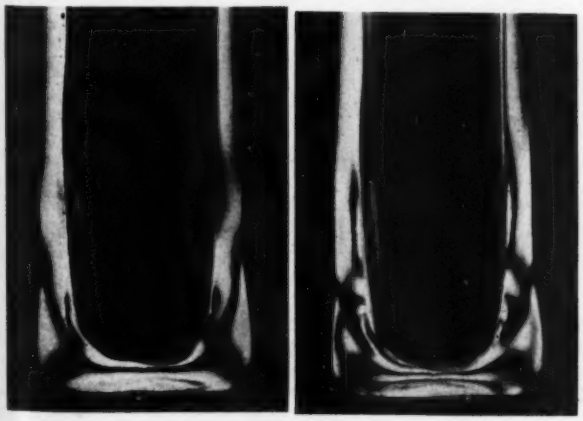
In Figure 2, the same bottle, at the same temperature, after several days, shows the "rock" well crystallized, and very severe strains in the walls and base of the bottle.

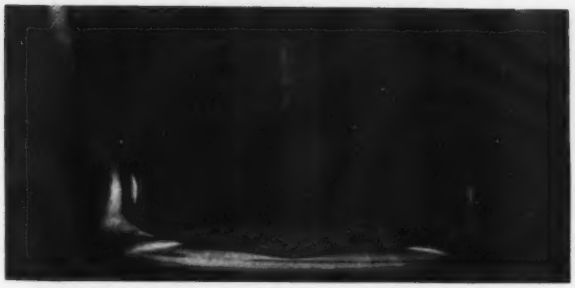
The polariscopic appearance of the stresses at 30°F., 50°F., 60°F., and 80°F., is shown in Figures 3, 4, 5, and 6.

Another bottle is shown in Figures 7 and 8. Here the annealing stresses are somewhat higher, but it is apparent that the stresses due to the crystals are vastly more severe than the annealing stresses. Figure 7 shows the bottle before the crystals formed; Figure 8, after. Both are taken at 70°F.

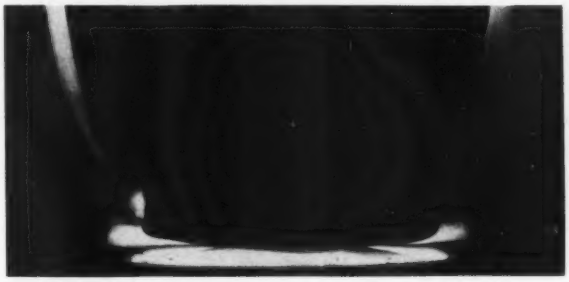


(Upper left). Fig. 9. Before Crystallization. 70° F.
(Lower left). Fig. 10. After Crystallization. 70° F.
(Upper right). Fig. 11. After Crystallization. 30° F.
(Lower right). Fig. 12. After Crystallization. 100° F.





(Above). Fig. 7. Before Crystallization. 70° F.
(Below). Fig. 8. After Crystallization. 70° F.



An edge view of a third bottle is shown in Figures 9, 10, 11, and 12. This bottle has relatively thick walls and the permanent annealing stress is well distributed. Hence this bottle when containing a cake of crystals is able to stand a greater temperature change than the other bottles shown.

As the temperature is lowered the stresses diminish, due to the greater contraction of the sugar mass as compared with the glass; but even at 30°F. the stresses in the "loaded" bottles are as high as at 70° with uncrystallized ones. Upon increasing the temperature above the crystallization temperature, 70° in this case, the greater thermal expansion of the sugar causes even greater stress. An increase of as much as 20° is apt to break all except the very rugged and well designed bottles.

Breakage takes place in poorly shaped bottles, such as squares or rounded rectangles, as a vertical split up one of the flat sides or edges, usually at a point about midway between the corners. The origin is on the outside surface, sometimes at a bruise, and at a point opposite and near the top of the cake of sugar crystals inside the bottle; i.e. ½ to 1 inch above the bottom of the sugar crystal mass when the mass is 1 inch thick. Circular bottles generally take the load well. Bottles for this product should have, for preference, an excess of glass in the lower parts of the sidewalls as compared with the top; but in any case should have a sufficient strength, either as a result of design or as a result of the manufacturing processes.

Bottles for holding Rock and Rye or comparable products, if we desire maximum strength with a minimum of glass; that is, if we are designing and manufacturing for maximum efficiency, should embody the following features:

(a) the bottle should be circular in cross section, at least in the lower parts
(b) the Murgatroyd belt should be rounded off into the base

(*Continued on page* 315)

CURRENT STATISTICAL POSITION OF GLASS

May witnessed the establishment of new records in the glass industry; production exceeded all previous totals, employment was at the highest level in history and payrolls hit a new peak. According to THE GLASS INDUSTRY's Production Index total output during May was valued at $39,000,000; this brought the first five months' production up to $178,000,000—a 23 per cent increase over last year.

Plate glass production during May amounted to 18,394,261 square feet according to the Plate Glass Manufacturers of America. This about equalled the previous month's total but was 57 per cent greater than in May, 1940. During the first five months of this year the total output of plate glass was a little over 90,000,000 square feet—a 31 per cent increase over the corresponding period of last year.

Window glass production during May dropped 9 per cent from the previous month's level to 1,281,515 boxes, which represented 78.9 per cent of the industry's total capacity. As compared with this, May 1940 production was 1,068,231 boxes, which represented 65.8 per cent of the industry capacity. During the five months, January through May, window glass plants achieved the record output of 7,057,000 boxes which was 24 per cent greater than last year's corresponding figure.

Glass container production during May broke all previous records, hitting a peak of 6,246,331 gross, according to the Glass Container Association of America. This volume was 17 per cent greater than in April and exceeded the May 1940 figure by 32 per cent. The total output of glass containers for the first five months of 1941 was 25,584,312 gross which was equal to 77 per cent of the industry's total productive capacity, and was 15 per cent higher than the previous record set in 1940.

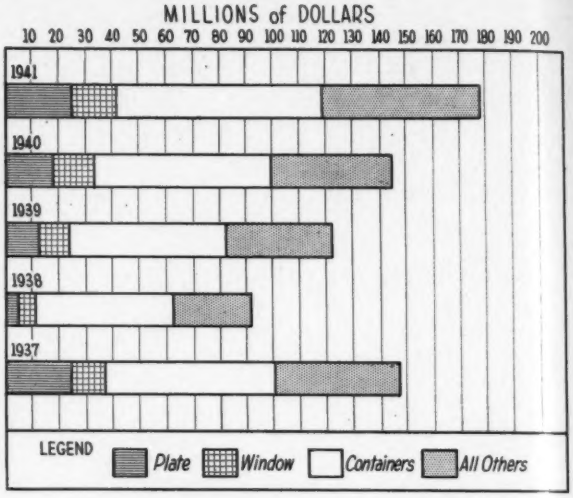
Shipments of glass containers during May were also at a record level, increasing to 6,401,707 gross—a 34 per cent gain over last year's corresponding month. An analysis of these shipments reveal that there were increases over May 1940 in all lines. Percentage-wise the largest gains were reported for domestic fruit jars (up 148 per cent), liquor ware (up 62 per cent), and general purpose ware (up 42 per cent); the rate of increase for the other lines ranged from 18 per cent to 37 per cent. Shipments for the five months (January through May) totaled 25,542,423 gross, which was 22 per cent above the 1940 level. Although gains were reported for every type of ware, the rate of increase in individual lines varied. Domestic fruit jar shipments advanced 155 per cent, beer bottles 40 per cent, domestic jelly glasses 38 per cent, general purpose ware 31 per cent, liquor ware and milk bottles 26 per cent, pressure and non-pressure ware 25 per cent, narrow-necked food containers 24 per cent, wide mouth food containers 21 per cent, medicinal and toilet ware 13 per cent and pressed food ware 3 per cent.

Stocks of glass containers as of May 31 in the hands of manufacturers totaled 9,243,767 gross—which was 8 per cent less than 1940's corresponding figure. Greatest declines were reported for domestic fruit jars (down 38 per cent), pressed food ware (down 22 per cent), milk bottles and narrow-necked food containers (down 20 per cent), and beer bottles (down 15 per cent).

Miscellaneous glass products manufactured during May had a value of $12,000,000—slightly less than the April total but $2,500,000 more than the corresponding

GI THE GLASS INDUSTRY'S INDEX

Production: Five Months, January Through May



CURRENT GLASS CONTAINER STATISTICS

(ALL FIGURES ARE IN GROSS)

Types of Ware	Production		Shipments		End of Month Stocks	
	May, 1941	May, 1940	May, 1941	May, 1940	May, 1941	May, 1940
Food Containers (Narrow neck, wide mouth and pressed)	1,638,300	1,295,417	1,587,135	1,252,468	2,039,540	2,113,029
Pressure and Non-Pressure Ware	627,528	554,993	779,402	637,649	727,876	752,308
Beer Bottles	569,097	310,564	548,345	396,939	857,396	984,718
Liquor Ware	959,791	606,026	991,276	623,266	1,380,991	1,410,955
Medicinal and Toilet Ware	1,647,891	1,367,521	1,609,075	1,269,592	2,969,936	3,219,536
General Purpose	468,058	323,310	453,398	317,697	533,652	573,342
Milk Bottles	258,410	199,004	272,191	198,931	278,423	347,981
Fruits and Jellies	49,346	36,089	136,375	59,132	410,836	638,824
All Others	27,930	22,010	24,510	21,404	45,117	37,207
Total Industry	6,246,351	4,714,934	6,401,707	4,777,078	9,243,767	10,077,900

figure for 1940. During the first five months of this year this branch of the industry ran 31 per cent ahead of 1940.

Production of automatic pressed tumblers during May totalled 5,548,353 dozens—an increase of 43 per cent over the May 1940 level. This brought the total for the first five months to 8 per cent above last year's volume. Shipments of this ware during May showed an expansion of 25 per cent to 5,055,004 dozens; the total for the first five months was 20,481,470 dozens as compared to 18,925,704 dozens in 1940. Stocks of machine made tumblers as of May 31 amounted to 7,896,104 dozens—5 per cent more than last year's total.

Manufacturers sales of machine made table, kitchen and household glassware were reported to have totalled 3,372,492 dozens which represented an increase of 26 per cent over last year's comparable month. During the twelve month period ending May 31, 1941 this trade amounted to 35,386,525 dozens—3 per cent greater than in the previous twelve months.

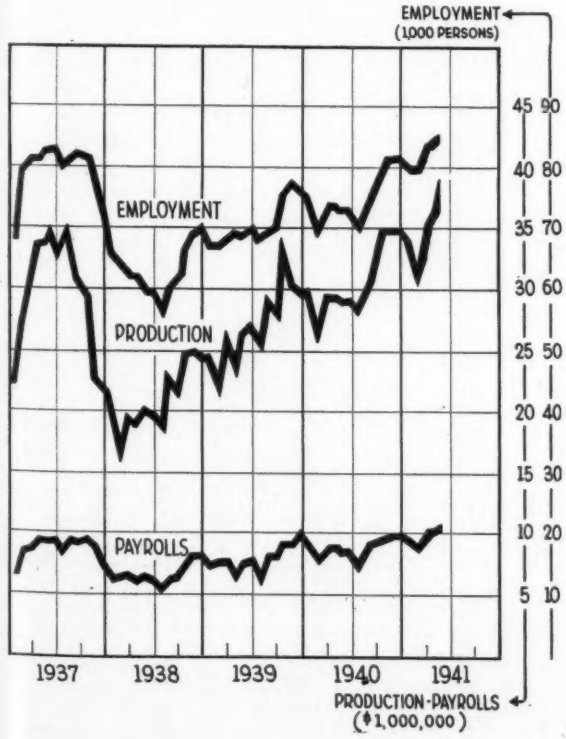
According to a preliminary release of the Bureau of Census, thirteen illuminating glassware manufacturers reported sales totalling $888,000 during May which was 43 per cent more than their May 1940 business and over 6 per cent over April 1941.

Employment and Payrolls: Approximately 86,000 persons were employed in the glass industry during May—the greatest number in history. This compared with 84,800 in April and 72,600 in May 1940.

Glass manufacturers paid out $10,900,000 in wages during May—another record figure. This was $400,000 more than the April total and exceeded May of last year by $2,800,000. During the first five months of 1941 the industry payroll was almost $51,000,000 as compared to $41,000,000 in 1940's corresponding year.

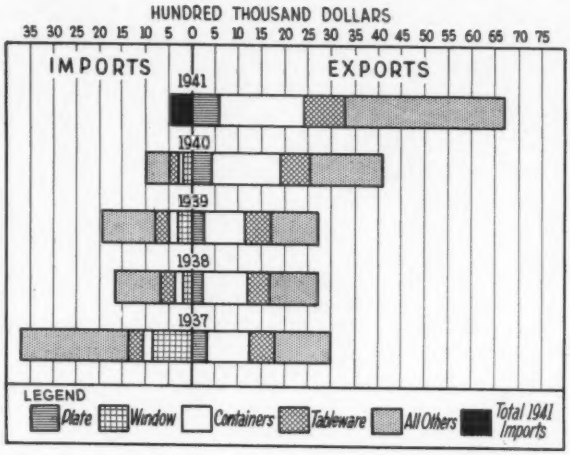
THE GLASS INDUSTRY'S INDEX

Monthly Trends Through May, 1941



THE GLASS INDUSTRY'S INDEX

Foreign Trade: Four Months, January Through April



Foreign trade statistics released by the Department of Commerce on June 16 showed that exports of glass and glass products during April dropped 8 per cent below the March figure to $1,680,000. However, this was 70 per cent greater than 1940's corresponding total, with all types of ware participating in the increased volume. Plate glass shipments to foreign markets were 151 per cent greater, containers were up 30 per cent, tableware 7 per cent, and illuminating ware 16 per cent; window glass exports were almost 20 times the April 1940 total. During the first four months of 1941 exports hit the record peak of $6,725,000—50 per cent greater than the comparable 1940 figure of $4,090,000.

Imports of glass and glass products had a value of $155,000 during April—a slight increase over the March total of $115,000. During the first four months of 1941, this trade amounted to $465,000 as compared to $1,037,000 last year.

UNITED STATES FOREIGN TRADE IN GLASS
(Values in Thousands of Dollars)

Exports	*April* 1941	*March* 1941	*April* 1940
Plate	148	148	59
Window	211	246	12
Containers	462	463	350
Tableware	201	213	188
Illuminating ware	72	73	62
All other	586	686	323
Total	1680	1829	994
Imports			
Total	155	115	270

PLANT FOR SALE—Bottle Plant of Tyler Glass Corporation, Paden City, West Virginia, with capacity of approximately 250,000 gross annually, is for sale. Address inquiries to L. J. Kihn Company, 285 Madison Ave., New York City.

INVENTIONS AND INVENTORS

A Summary of United States Patents of Interest to the Glass Industry Issued During May

Compositions

George Morey's work in the field of non-silicate optical glasses of high refractive index is being extended by the Eastman Kodak Co., as is indicated by patent 2,241,249 issued May 6 to Leon W. Eberlin and Paul F. De Paolis of Rochester. In highly corrected optical systems such as photographic lenses where each flint glass element is accompanied by a supplementary crown glass unit, it is useful if the latter has both its refractive and dispersive indices higher than those of the flint glass, and the difference should be fairly large. From the standpoint of the lens designer it would be advantageous if crown glasses with refractive index of about 1.72 and dispersive index of 47 were available for use with the numerous fine flint glasses having indices of about 1.60 and 40. To apply these high refractive index glasses Eberlin and Paolis have found that satisfactory compositions can be made from a batch containing 15 to 35 per cent lanthanum oxide, 5 to 15 per cent thorium oxide, 28 to 37 per cent boric oxide, 10 to 20 per cent tantalum and or tungsten oxide and 5 to 25 per cent oxides from the group consisting of barium, calcium, strontium and magnesium. The batch may include a small amount of beryllium oxide, and a small quantity of the usual alkalies may be used to secure easier fluxing.

The following table gives four typical compositions with their optical indices.

	A	*B*	*C*	*D*
Lanthanum Oxide	28%	28%	24%	20%
Tantalum Oxide	18	—	15	12
Tungsten Oxide	—	18	—	—
Thorium Oxide	12	12	9	12
Barium Oxide	12	12	10	20
Strontium Oxide	—	—	10	—
Boric Oxide	30	30	32	36
Refractive Index	1.745	1.725	1.720	1.702
Dispersive Index	47	45	49	50

Luminescent materials and their application were the subject matter of patent 2,240,706 granted to Russell R. Law of West Orange, N. J. (R. C. A.), and of the three following patents assigned to General Electric Co.: 2,241,939 to Günther Aschermann and Ernst Friederich, Berlin-Charlottenburg, Germany; 2,241,950 and 2,241,951 to Magdalene Hüninger, Berlin-Charlottenburg, and Hans Panke, Berlin. It is interesting that this international cooperation between inventors and their American assignee has not encountered wartime conditions causing stoppage of communication. Each of these three patents was filed since the war began and one of them as recently as Oct. 28, 1940.

Bennett S. Ellefsen, St. Marys, Pa., assigned to Hygrade Sylvania Corp. his patent 2,242,061 for a fluorescent screen material made by mixing ZnO, SiO_2 and BeO and an activator, and melting the mixture to form a zinc beryllium silicate, and then devitrifying below the melting temperature to increase the fluorescent intensity.

Furnaces

The need for securing the highest degree of uniformity in optical glass necessitates the familiar process of breaking up the entire melt and normally discarding more than 75 per cent of the batch due to cords and stria. John C. Hostetter, West Hartford, Conn., states in patent 2,242,129, assigned to Corning Glass, that much of the non-uniformity develops due to a washing action along the sides of the container particularly during the cooling period. It is of course impossible to stir the glass while it is cooling. He suggests a method of installing thermal insulation (Fig. 1) which may be removed progressively from the furnace, first from the bottom and then from higher levels. Such a practice is said to reduce convection currents which wash the container walls. Immediately upon completion of the fining operations, cooling of the glass is commenced by removing the insulation from the entire container bottom. The purpose is to solidify as rapidly as possible the contaminated layer of glass in contact with the bottom refractory. Further removal of insulation from the sidewalls is directed toward minimizing temperature differences between different parts of the glass, and particularly across any given level of depth.

As illustrated in Fig. 1, Hostetter provides a rack which supports the sidewall insulation in such a way as to allow it to be lifted from the furnace walls progressively.

Vergil Mulholland of West Hartford, Conn., has patented some novel features designed to contribute to the uniformity of production of continuous tank furnaces by confining unfused batch more closely to the melting end (2,241,611; Hartford Empire). As shown by Fig. 2, the doghouses 20 and 21 are arranged at the corners of the tank so as to make an angle of about 45° with the center line of the tank. Burners 9 and 10 are of the

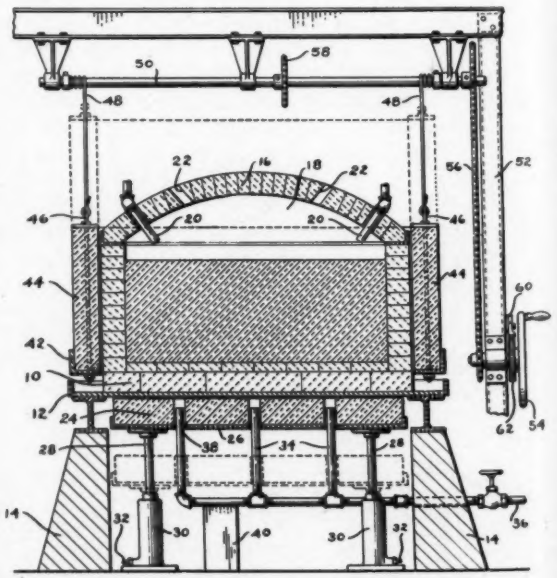


Fig. 1. 2,242,129: Hostetter. To reduce cords formed in optical glass during cooling, insulation is removed first from the container bottom and then is progressively lifted from the walls.

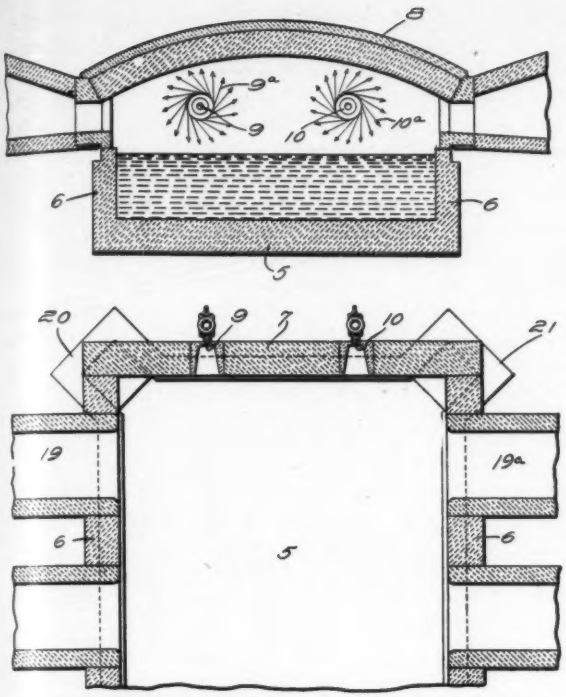


Fig. 2. 2,241,611: Mulholland. Symmetry of melting is advanced by placing the doghouse angularly to the furnace, operating them in turns while only the opposite burner is in use.

type which swirl the air to shorten the flame and to improve mixing of fuel and air.

Novel features are the practice of having the burners swirl in opposite directions and of operating them one at a time while likewise only one of the doghouses is operating. Preferably that doghouse would be in use which is opposite from the operating burner. Air to support combustion is introduced alternately from one side of the furnace and then the other through ports 19 and 19a, that port operating which is nearest the operating burner. These features are said to contribute considerably to the symmetry of the melting operation.

Emile Roirant, Paris, in patent 2,241,161 assigned to Societe Continentale d'Appareils Mechaniques Pour la Verrerie, Basel, Switzerland, provides rotating basins at two corners of the fining end of a continuous furnace from which automatic forming machines withdraw suction charges. These basins are fed from troughs which are air cooled to improve refractories service.

Feeding, Forming and Shaping

A spring-acting cutoff to sever the suction charges

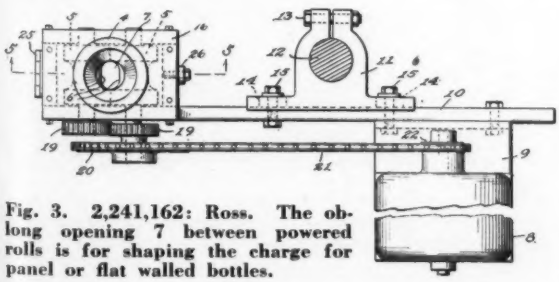


Fig. 3. 2,241,162: Ross. The oblong opening 7 between powered rolls is for shaping the charge for panel or flat walled bottles.

picked up by blank molds was patented by Clarence C Kinker of Montreal (2,243,756; Owens-Illinois). This is said to give a quick acting unit with enough yield to prevent damage to the knives if obstructions develop.

James W. Ross of Washington, Pa., states in patent 2,241,162 assigned to Hazel-Atlas Glass Co., that the conventional round charges and round blank molds give a parison which is not well adapted to blowing odd shapes such as that of panel type bottles. One means of changing the shape of the glass charge was suggested in the Thomas Stenhouse patent 2,020,623 granted Nov. 12, 1935. Ross provides another form of apparatus designed to roll the blank into flattened shape before it drops into the blank mold. As is shown in Fig. 3 the charge is led by a funnel-shaped charging tube into the opening 7 between two high speed rolls 5, which are cut away in such a manner as to give an opening which rolls the gob into flattened form. The driving means for the rolls is shown as a motor at 8. When a charge of ware requires a different gob shape, the two rolls are replaced by others of more suitable design.

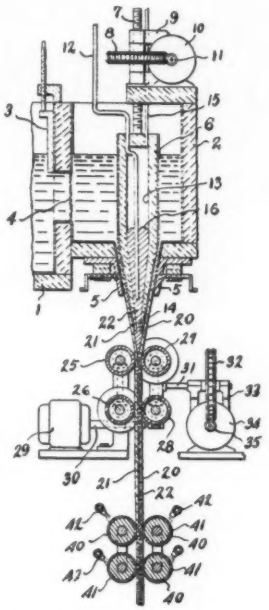


Fig. 4. 2,243,194: Cook. Safety glass formed by pressing sheets 20 and 21 together with a binder layer is given a steam polish at the lower rolls.

In suction gathering machines there are several conditions including forehearth inhomogeneity which may give a blank which is hotter on one side than another. According to Albert F. Tremblay in patent 2,243,267 (Kent-Owens Machine Co., Toledo), when the blank is barred by the mold, it is apt to become shorter on the relatively cool side, thereby resulting in curvature and the swinging of the bottom of the blank to one side. Tremblay proposes corrective measures which may apply to undesirable blank curvature due to any other cause, as well. As the parison hangs by its neck from the blank mold, the bottom of the blow mold moves into contact with the parison bottom and together they are aligned to the axis of the blow mold.

Miscellaneous Processes

It has been found that in glass annealed in an atmosphere containing acid gases the surface durability is higher than that of glass ware annealed in an atmosphere free from such gases. In one patented process used commercially, pellets of sulphur are dropped into the glass bottles to be treated, to form a suitable sulphurous atmosphere within the bottle while it is being annealed. Joseph F. Greene of Vineland, N. J. (Kimble Glass Co.), has just proposed in patent 2,241,511 that the sulphur or other acid-gas-forming material be mixed with the

fuel oil used for firing the annealing lehr. The acid gas then enters the lehr with the products of combustion and is said to improve the durability of the glass.

Miscellaneous patents of interest are 2,241,505 to Moses J. Cuttler, New York, for a metal-to-porcelain seal, 2,243,778 to Thomas J. Stansel, Clarksburg, W. Va., for an attachment to a ferrule to enable glass cutters to obtain greater precision in cutting flat glass, and 2,243,-313 to James L. Herold, St. Louis, and Frederick W. Wehmiller, Ladue, Mo. (Barry-Wehmiller Machinery Co.), for a device for delivering rows of spaced containers to pasteurizers or other machines.

George W. Batchell of Toledo was granted patent 2,243,145 for a paneled lehr belt.

Plate and Sheet Glass

A means of steam polishing a glass sheet while it is being drawn downwardly from the forehearth is described in patent 2,243,194 to Everett J. Cook of Toledo. As shown in Fig. 4, the forehearth has a tapered outlet element or arbor 6, along the sides of which glass is drawn to form two sheets between which an intermediate binding layer 22 is fed from the hollow arbor. The two sheets are brought together between driven pressure rolls. Before the glass has completely solidified it is given a steam polishing at the lower rolls 40, 41, which are surfaced with soft carbon and kept moist by water spray. The steam is believed to actually prevent contact between the glass surfaces and the carbon film.

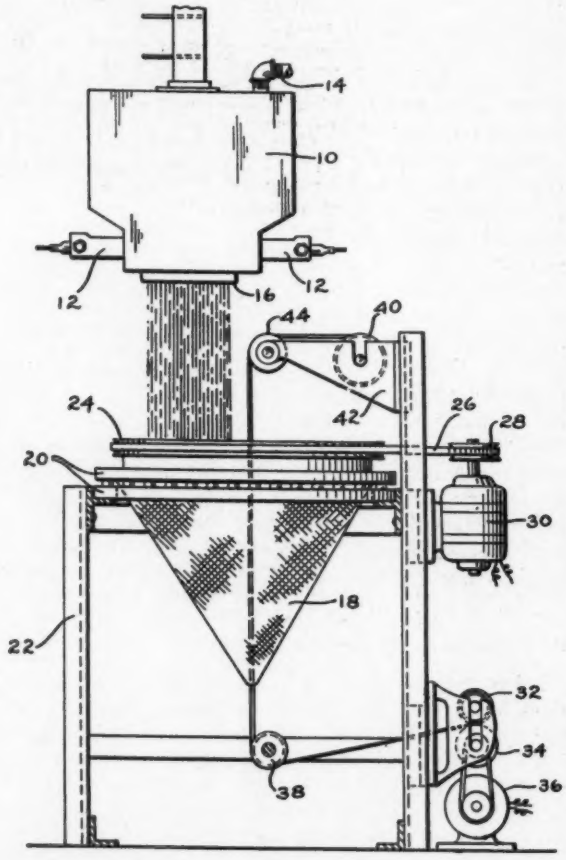


Fig. 5. 2,241,405: Hyde. Glass fibers collected on screen cloth which forms on a fast revolving cone, emerge as a twisted yarn at the bottom.

Patent 2,242,019 to Adolf Weihe, Bad Soden, Taunus, and Fritz Herrlein, Frankfort-on-the-Main-Hochst, Germany (assigned to General Analine & Film Corp., New York), is limited to a laminated glass comprising at least two sheets of glass and at least one intermediate layer comprising a condensation product of a polyvinyl alcohol with methylcyclohexanone and the neutral ester of diglycolic acid with methylcyclohexanol.

In view of the present advanced development of the tempering or case hardening process as applied to safety glass it is surprising to see the issuance of so broad a patent as 2,243,149 granted May 27, 1941 to George P. Despret of Paris, France (American Securit Co.). In lieu of the normal process wherein the sheets are cut to final size before tempering, Despret has patented the method of moving a continuous glass ribbon from the furnace, through a uniform temperature zone and then immediately to the cooling chamber, and then cutting it to the desired size by gas flame or electric means. The patent was applied for Feb. 10, 1936, and was therefore in the office five years which is somewhat longer than normal.

Glass Wool and Fiber

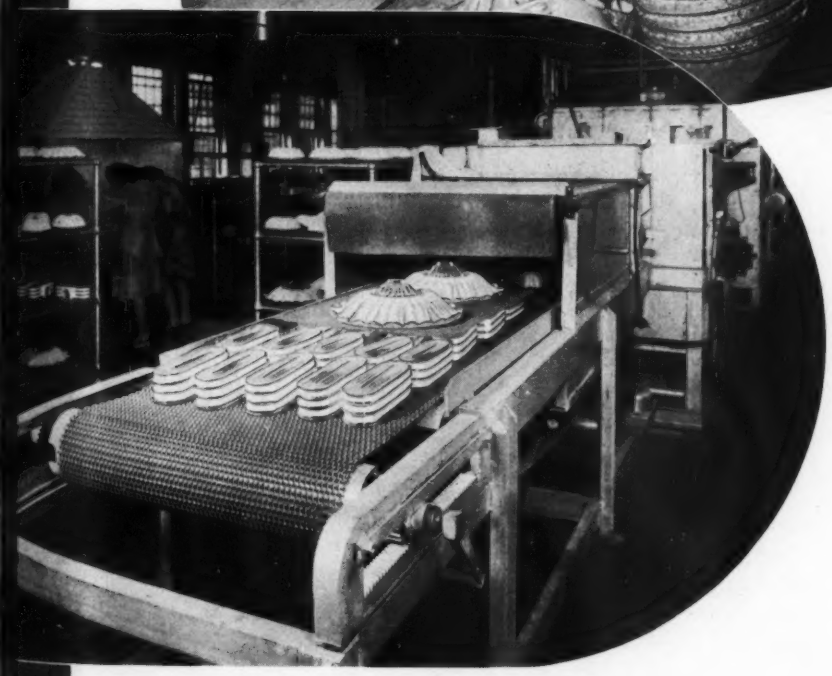
Fig 5. illustrates the apparatus presented in patent 2,241,405 by James F. Hyde, Corning, N. Y., and Stuart M. Dockerty, Newark, Ohio (Owens-Corning Fiberglas Corp.), for forming twisted coatings of glass fibers adapted for fabrication into textile products. Such fibers have commonly been collected as thin webbing, folded together to form a sliver, wound on tubes, and subsequently spun into the final form in a series of disconnected processes. The Hyde-Dockerty method catches the fibers on a cone made of screen cloth which rotates at 2,000 to 10,000 R P M and winds them into a twisted yarn or roving which is drawn off from the apex of the cone. In the example illustrated by Fig. 5 the yarn is wound directly on a core material 44, such as an electrical conductor, which is directed through the cone. As is usual the fibers are formed by an air blast which draws them from the molten supply. The screen cloth surface of the cone allows passage of the air blast.

Patent 2,243,122 to Charles F. Ramseyer, Chicago, Ill., is directed primarily to making slag wool, but is of broader interest since it utilizes the forming process in which the fibers are thrown from fast revolving discs. The discs have numerous separate groovings from each of which the fibers are thrown.

WANTED—Man experienced in decorating lehr, silk screen printing machines and spray equipment with supervisory experience. Box 40, THE GLASS INDUSTRY, 11 West 42nd St., New York City.

WANTED good man to take charge of Fourcault plant in Canada. Must have a complete knowledge of batch, tank, temperature and machines. Good salary and good opportunity. Apply stating references to Industrial Glass Works Company Ltd., St. Laurent, P. Q. Quebec. Replies will be kept strictly confidential.

30" LEHR WITH A 60" CAPACITY



● The lehr shown in the illustrations has a 30" wide belt. By means of stacking, the capacity of the lehr can be doubled or made equivalent to a lehr having a 60" wide belt.

Stacking of the ware 2 or 3 pieces high is common practice in many SC Continuous Annealing and Decorating Lehrs. It is made possible by application of convection heating accomplished in all SC lehrs by the principle of recirculation.

SC decorating lehrs may be either direct-fired or heated by means of SC Radiant Tubes . . . depending on the required cross-section of the tunnel. The absence of a muffle and heavy refractories is reflected in flexibility, rapid heating up time, surprisingly low fuel consumption and comparatively little floor space required.

In the lehr shown, the fuel consumption is only 250 cubic feet of natural gas per hour when operating on a two hour cycle. With the average cost of natural gas, the fuel cost for operating this lehr is less than a dime per hour.

SURFACE COMBUSTION CORPORATION, TOLEDO, OHIO

* SECURITY FOR AMERICA *

SURFACE COMBUSTION

MANUFACTURERS OF INDUSTRIAL FURNACES · JANITROL GAS-FIRED SPACE HEATING EQUIPMENT · AND KATHABAR AIR CONDITIONING SYSTEMS

CURRENT PRICES OF GLASS-MAKING MATERIALS

FURNISHED BY PRODUCERS, MANUFACTURERS AND DEALERS

Base Materials

		Carlots	Less Carlots
Barium carbonate ($BaCO_3$), Crude, (Witherite) 90%, 99% through 200 mesh	ton	45.00	48.00-51.00
Precipitated material		45.00	50.00
Barium sulphate, in bags	ton	19.00	24.00
Barium sulphate, glassmaker's, carlots, bulk f. o. b. shipping point	ton	15.00-16.00	18.00
Borax ($Na_2B_4O_7 10H_2O$)	lb.	....	....
Granulated	In bags, lb.	.0215	.027-.0295
Powdered	In bags, lb.	.024	.0295-.032
Boric acid (H_3BO_3) granulated	In bags, lb.	.048	.054-.0565
Calcium phosphate ($Ca_3(PO_4)_2$)	lb.	.07	.07½
Cryolite ($Na_3Al\ F_6$) Natural Greenland (Kryolith)	lb.	.0865-.0875	.0925
Synthetic (Artificial)	lb.	No supplies available.	
Feldspar—(published list prices)			
20 mesh	ton	11.00-13.25	
40 mesh	ton	11.50-13.75	
Granular	ton	11.75-14.00	
Semi-granular	ton	11.00-13.25	
L. C. L., (Min. 2 tons) $3.00 per ton additional plus charge for bags			
Fluorspar (CaF_2) domestic, ground, 96-98% (max SiO_2, 2½%)			
Bulk, carloads, f. o. b. mines	ton	29.00	....
In bags	ton	30.60	40.00-42.50
Kryolith (see Cryolite)			
Lead Oxide (Pb_3O_4) (red lead) (N. Y.)	lb.	.0835	....
In 5 Ton lots	lb.	....	.0875
Less than 5 Tons	lb.	....	.0925
Lime—			
Hydrated ($Ca(OH)_2$-MgO) (in paper sacks)	ton	8.50	8.50
Burnt (CaO-MgO) ground, in bulk	ton	7.00	....
Burnt, ground, in paper sacks	ton	9.00	9.00
Burnt, ground, in 180 lb. drums	Per drum	1.60	1.70
Kiln Dried ($CaCO_3$-$MgCO_3$) 10x30 mesh	ton	1.75	....
Kiln Dried ($CaCO_3$-$MgCO_3$) 16x120 mesh	ton	1.75	....
Nepheline Syenite, f. o. b. shipping point	ton	12.00	15.00
Potassium carbonate—			
Calcined (K_2CO_3) 96-98%	lb.	.065	.0675
Hydrated 80-85%	lb.	.055	.0575
Salt cake, glassmakers (Na_2SO_4) in bags	ton	18.00-20.00	25.00
in bulk		16.50	
Soda ash (Na_2CO_3) dense, 58%—			
Bulk	Flat Per 100 lb	.95	....
In barrels	Per 100 lb.	1.35	....
In bags	Per 100 lb.	1.10	....
Sodium nitrate ($NaNO_3$)—			
Refined (gran.) in bbls	Per 100 lb.	....	2.50-2.90
95% and 97%			
Bulk	Per 100 lb.	1.35	....
200 lb. bags		1.44	1.465
100 lb. bags		1.475	1.50

Special Materials

		Carlots	Less Carlots
Aluminum hydrate ($Al(OH)_3$)	lb.	.026-.029	.04
Aluminum oxide (Al_2O_3)	lb.	....	.09
Antimony oxide (Sb_2O_3)	lb.	.14	.14½
Arsenic trioxide (As_2O_3) (dense white) 99%	lb.	.03½	.04¼
Barium nitrate ($Ba(NO_3)_2$)	lb.	....	Open price.
Pyrophyllite, (20% Al_2O_3)	ton	9.00	12.00
Sodium fluosilicate (Na_2SiF_6)	lb.	....	
Tin Oxide (SnO_2) in bbls	lb.	....	.55
Titanium Oxide (ceramic grade)			
In bags	lb.	.13	.13¼-.13¾
In barrels	lb.	.13¼	.13½-.14
Zinc Oxide (ZnO)			
American process, Bags	lb.	.06½	.06¾
White Seal, 150 lb. bbls	lb.	.09	.09¼
Green Seal bags	lb.	.08¼	.08½
Domestic White Seal bags	lb.	.08¾	.09
Red Seal, bags	lb.	.07¾	.08
Zircon			
Refined Granular (Milled .01-.02c higher)		.06½	.07-.08

Coloring Materials

		Carlots	Less Carlots
Barium selenite ($BaSeO_3$)	lb.	....	1.40-1.60
(Commercial, 25% Selenium)	lb.	....	.85
Cadmium sulphide (CdS)	lb.	....	1.10-1.15
Cerium hydrate—			
100 lb. drums and 600 lb. barrels	lb.	....	.60
Chrome Oxide Green, 400 lb. bbls.	lb.	....	.24-.27
Chromite (99% through 200 mesh)	ton	55.00	58.50
Chromite ore (air floated)	ton	55.00	58.00-73.00
Cobalt oxide (Co_2O_3)			
In bbls	350 lbs. or more, lb.	....	1.84
	Less than 350 lbs., lb.	....	1.94
Copper oxide—			
Red (Cu_2O)	lb.	....	.20-.22
Black (CuO)	lb.	....	.19-.22½
Black prepared	lb.	....	Open price.
Iron Oxide—			
Red (Fe_2O_3)	lb.	....	.05½-.09¾
Black (Fe_3O_4)	lb.	.04½	.09
Iron Chromate	lb.	....	.035-.06
Lead Chromate ($PbCrO_4$) in bbls	lb.	....	.145
Lithium Carbonate	lb.	....	1.25
Manganese, Black Oxide (Caucasian)			
In Paper bags	ton	70.00	78.00
In Burlap bags	ton	71.75	79.75
In Casks	ton	74.00	82.00
Neodymium oxalate, 50 lb. drums	lb.	....	4.00
Nickel oxide (Ni_2O_3), black	lb.	....	.35-.40
Nickel monoxide (NiO), green	lb.	....	.35-.37
Potassium bichromate ($K_2Cr_2O_7$)—			
Crystals and Granular	lb.	.09½	.09¾-.10
Powdered	lb.	....	.10¼-.10½
Potassium Chromate (K_2CrO_4) 100 lb. kegs	lb.	....	.27
Powder blue	lb.	....	.21-.25
Rare earth hydrate—			
100 lb. drums	lb.	....	.35
325 lb. barrels	lb.	....	.30
Selenium (Se) In 100 lb. lots	lb.	....	1.75
In lesser quantities	lb.	....	1.85
Sodium bichromate ($Na_2Cr_2O_7$)	lb.	.07¼	.07½-.07¾
Sodium chromate (Na_2CrO_4) Anhydrous	lb.	.08⅛	.08⅜-.09⅛
Sodium selenite (Na_2SeO_3)	lb.	....	1.50-1.65
Sodium uranate (Na_2UO_4) Orange	lb.	....	1.65
Yellow	lb.	....	1.65
Sulphur (S)—			
Flowers, in bbls	Per 100 lb.	3.35	3.70-4.10
Flowers, in bags	Per 100 lb.	3.00	3.35-3.75
Flour, heavy, in 250 lb. bbls	Per 100 lb.	2.90	3.25-3.65
Uranium oxide (UO_2) (black, 96% U_3O_8) 100 lb. lots. Black	lb.	....	2.55
Yellow orange	lb.	....	1.65

Polishing Materials

		Carlots	Less Carlots
Emery, Turkish	lb.	.072	.08
Pumice Stone,			
American Ground Italian FFF, FF, F	lb.	.... } open	
0, 0½, ½, 1	lb.	.... } price	
Putty Powder	lb.	Open price.	
Rotten Stone, (Domestic)	lb.	02¼	.03½
Rouge, Red	lb.	....	.16
Black	lb.	....	.18

ANTI-TRUST TRIAL TAKES SUMMER RECESS

Since the Government failed to complete its presentation of evidence in the anti-trust suit against major glassware manufacturers before the summer adjournment, the investigators of the anti-trust division now will have all summer in which to "fine tooth" comb correspondence seized from the defendants. On June 18, Judge Frank L. Kloeb recessed the case at the same time displaying some impatience with the Department of Justice for having failed to complete its case in the space of 13-weeks. Originally the government estimated it would take six weeks to present its case.

When the recess was declared the record in the case filled 5,900 pages and there were well over 1,500 exhibits in the files of the clerk. The case will not resume until at least the middle of October. On the present indications the Government will require only a few more days in which to finish; however this may grow longer if the "fine tooth combing" is productive of results.

Mr. Isseks produced a "surprise witness" during the last week of the trial—surprise both to the Government and the defense—in the person of one Harry D. Hartley, former head of the defunct Turner Glass Co.

If Mr. Hartley's testimony was worth anything, a matter of considerable dispute, it may tie in the Glass Container Association, one of the defendants which seemed most likely to escape on a motion to dismiss at the close of the Government case.

Mr. Hartley testified that back in 1929 and 1930 he was a member of the Glass Container Association, and was a member of one of its committees. He was confused as to whether this was the executive committee or the statistical committee. At any rate, upon questioning, he testified that there definitely had been conversations about production control and price fixing at the meetings which he attended.

Upon first hearing Mr. Hartley's testimony was startling, but it lost some of its sting, when studied in its entirety. In the face of Mr. Hartley's emphatic statement to the contrary, he declared at another point in his testimony that the discussions in question did not occur at the formal sessions of the group, but in informal discussions in the corridor, or outside the meeting room. Mr. Hartley also declared that Mr. Stevensen, manager of the Glass Container Association always contended the Clayton Act was a "wrong law." The witness quoted Mr. Stevensen as saying he intended to change the Clayton Act, if he had to violate it to do it.

Upon resuming his testimony after a recess, Mr. Hartley requested permission to go through the transcribed record of his previous testimony and to change it in many places. This was granted. But when, after his final appearance on the stand, he wrote a long letter to Judge Kloeb, again requesting permission to change his testimony, it was decided to disregard his final request.

Vernon Dorsey, portley and picturesque counsel for Corning Glass Works, and in years gone by for Hartford-Empire Co., was one of the most important witnesses heard during the June session. Mr. Dorsey held his own with the government attorneys, obviously being better versed in patent law than Samuel S. Isseks, the examining attorney. He made a good impression on observers, and defense attorneys thought he was wonderful.

DESIGN OF BOTTLES

(*Continued from page* 307)

(c) the sidewalls should be thicker near the base than near the shoulder

(d) a modest "disannealing," or a moderate "residual annealing strain" will normally help.

In general it may be noted that good design and construction for this type of ware does not differ in any important respect from the conditions that should be met in other types of ware already discussed in previous articles.

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[1]Bottles for Internal Pressure, by F. W. Preston, *Glass Industry*, June, 1940.

[2]Bottles for Internal Vacuum, by F. W. Preston, *Glass Industry*, December, 1940.

[3]Private communication from Dr. Bernard Vonnegut of the Hartford-Empire Company. He measured the linear coefficient of thermal expansion of the sugar crystals and obtained with moderate accuracy the value 40×10^{-6}.

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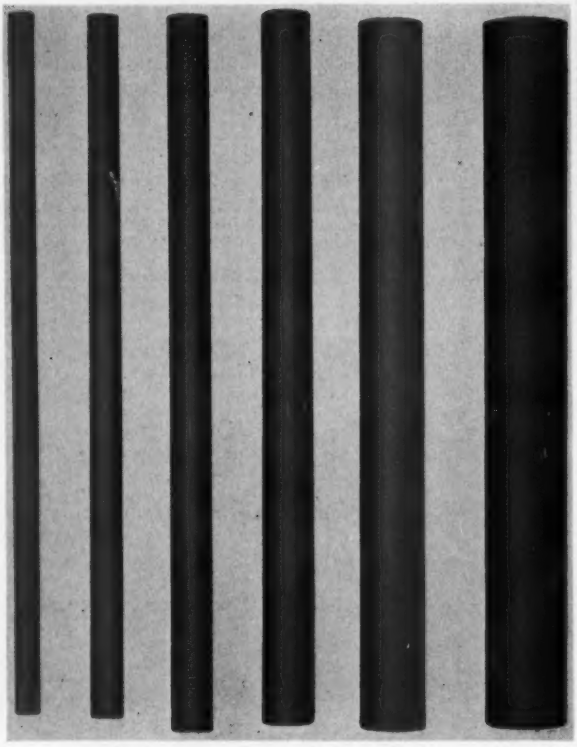

1/8" 3/16" 1/4" 3/8" 5/8" 1/2" x 6"

IN the manufacture of Malleable Rods a "white iron" is produced Fe3C. The carbon is present in the combined form. The "white iron" castings are annealed or graphitized so that the final structure consists of ferrite (Fe) and free carbon (C) which is in the form of "temper" carbon.

This material is very soft and will pein readily.

Machinability

It is generally known, in commercial operations, Malleable iron machines more readily than other ferrous materials of equal tensile properties.

May we send you a descriptive booklet or answer questions on your specific problems?

GUNITE FOUNDRIES CORPORATION

ROCKFORD ILLINOIS

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BORAX STRIKERS STILL OUT

On Saturday, June 21, striking C.I.O. workers at the Trona, California, plant of the American Potash & Chemical Corporation rejected the Corporation's most recent proposals and the walk out which has been paralyzing the borax industry for more than three months is still effective. As this issue of THE GLASS INDUSTRY goes to press, efforts to end the deadlock are continuing.

During the past ten years four producers in this country have supplied approximately 95 per cent of the world's requirements of borax and boric acid. Two producers are large and two are small. Production as high as 360,000 tons has been recorded annually for crude and refined borates, and this tonnage of crude results in an approximate equivalent amount of refined material. In normal times about 40 to 45 per cent of crude and refined were exported, but since the war shipments to France, Germany, etc., have been eliminated from the export market. Japan has also been eliminated due to licensing control. This limiting of the export market threw the surplus back upon the United States, but domestic requirements have offset the loss of exports.

Glass and enamel ware account for the bulk of borate consumption, and the expansion of both industries have imposed heavier demands upon borate producers. Borosilicate glasses, requiring large quantities of borax and boric acid (made from borax), have become a factor in the defense program; but all glass production is running at record high levels. In the enamelware field, housing projects and army cantonments have increased the demand for bath tubs, sinks, cooking utensils, etc.

At the time when the demand for borax was at its peak, a strike was called on March 14 at the only source of supply of one of the principal producers, the plant of the American Potash & Chemical Corporation at Trona, California. The situation soon became acute. For several weeks the other producers tried to meet the shortage, largely from stocks, but it was a losing battle. Recently, the Government placed borax on the priorities list under full priority control, and started to dole out the borax on hand in limited quantities.

Saturday, June 21, the striking C. I. O. workers (by a vote of 260 to 174) rejected the Corporation's proposals to end their walkout. The union originally demanded a minimum wage of $1, with a maximum of $1.50, and a closed shop. Before the strike, employees were receiving a minimum of 62½ cents for Mexican labor and 67 cents for other common labor, while mechanics and machinists pay was $1.05 per hour. The Corporation's latest offer included a wage scale of 78 cents per hour, minimum, to $1.20 per hour, maximum. Also, the Corporation agreed (1) that any employee who is now a member of the signatory union shall, as a condition of continued employment, maintain his membership in good standing, (2) that no new employee shall be engaged in any department until all employees who were on the pay-roll of that department on March 14, 1941, shall have been given an opportunity for employment and that there would be no discrimination between union and non-union men, and (3) that the union would have the right to solicit membership and the Corporation would recommend to each new employee that he join the union at the end of a probationary period of 45 days and maintain membership in good standing.

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. . . the tank block of accurate structure balance made by ceramic experts from a precision blend of fire clays, including the famous Missouri Washed Pot Clays.

Fluxtite and its companion products, Laclede's Super Refractory Mix 89 and Laclede's Refractory Upperstructure, have been and are now meeting the strict requirements of the producers of soda-lime, boro-silicate and all other glasses.

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Flashed Opal Blown Sheet Glass
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Heat-Ray Resisting (Cool Glass)
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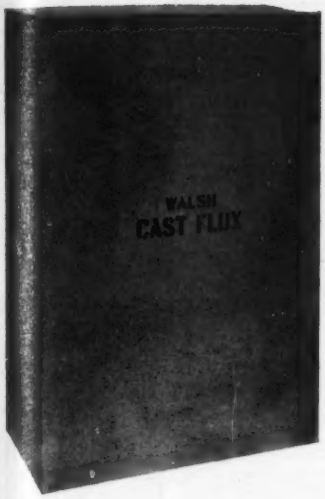

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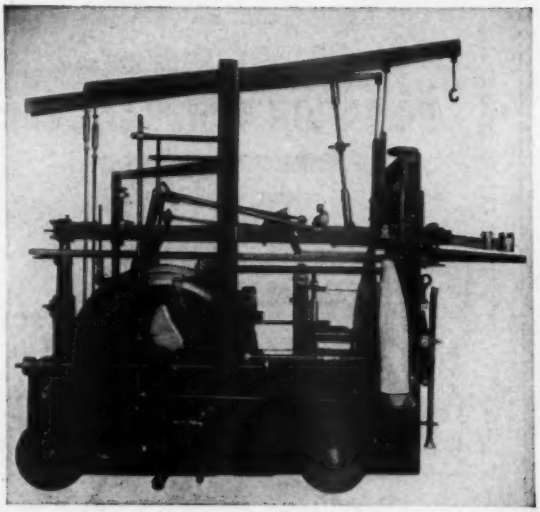
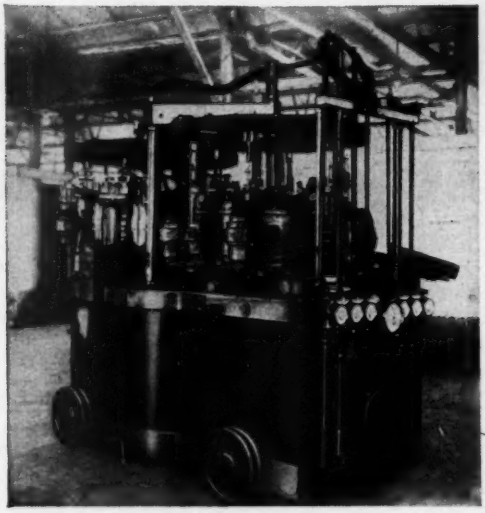


Type "F" single - mould suction machine for the production of small ware

Type "A6" twin table six-arm suction machine for the production of bottles



Also type "B" single-mould suction machine for bottles and type "BB2" suction machine for carboys up to a capacity of about 14 gallons

Any particulars from:

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